

REMARKS

Amendments to the Claims

Claims 1 and 3 are herein amended, and claims 2 and 10-16 are cancelled. Claim 1 is amended to rearrange the listing of the membrane layers to claim the middle layer before the barrier layer, for reasons of logic, to add the limitations for the composition of the middle layer from claim 2, which is now cancelled, and to add limitations for the composition of the barrier layer from language found in original claim 10.

Rejections under 35 USC 112, para. 1 – Written Description/New Matter

Applicants have amended claim 1 to delete the term “covalently”. Therefore, Applicant respectfully submits that claim 1 does not contain new matter and so requests withdrawal of the new matter rejection and reconsideration.

Rejections under 35 USC 10 – Anticipation

The Examiner has maintained rejections of claims 1-6, 8, 9 under 35 U.S.C. 102 (b) as being anticipated by Mahendran et al (US 5,914,039) (hereinafter ‘039). As amended, claim 1 now recites that the middle layer is selected from the group consisting of “an epoxy, a polyurethane, a silicone, an adhesive, a monomer, a polymer, and a combination thereof” and the barrier layer now recites that the barrier layer consists of “8-60% of at least one hydrophobic polymer, 1-20% of at least one hydrophilic polymer, 1-20% of an inorganic additive, 1-10% of a monomer, 1-10% of an organic additive, and solvent”. Applicant respectfully submits that the ‘039 patent does not disclose a membrane having three layers; namely, a support layer, a middle layer consisting of the recited compositions, and a barrier layer that consists of the recited compositions and in fact, does not disclose a distinguishable middle layer at all (see col. 3, lines 52 – 64, “...extruding *the* dope on to the support at a rate sufficient to form a *continuous layer* of dope...”, emphasis added). Note the reference in ‘039 to a single doping material added directly to the support layer (braid) to form a *single continuous* layer on the braid support. The dope is not added to an adhesive, or other layer already present on the support layer. In the ‘039 patent, the single continuous layer of dope is added directly to the support

layer and forms a single continuous layer covering the support - there is no distinct middle layer.

Applicant therefore respectfully submits that claim 1, and all claims which depend therefrom, are novel over the cited prior art. Reconsideration of the claims and withdrawal of the anticipation rejection under 35 USC § 102(b) are therefore requested.

35 USC § 103(a) Rejections – Obviousness

Claim 7 stands rejected for obviousness based on the '039 patent combined with patent '473. Given that the '039 patent, the base reference of the obviousness rejection by the Examiner does not disclose all the elements of the presently claimed membrane (see above), the combinations of '039 with Strobel (US 5,766,473 – hereinafter the '473 patent) to reject claim 7 and '039 with Cooper (US 3,676,193 – hereinafter the '193 patent) to reject claims 2 and 4 likewise do not teach all the elements of the membrane of claim 1 in the instant application.

Moreover, there is no suggestion in the references themselves, or the knowledge available in the art for the '039/'473 combination. As stated in the previous response, combining patent '473, which discloses “a supporting structure having a complex geometric configuration and an extremely thin hydrophilic polymer shell” (col. 4, lines 7-10), with patent '039 renders the '039 patent unsatisfactory for its intended purpose. According to MPEP § 2143.01(V) “If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).” Patent '039 states that “The novel membrane provides about 50% higher specific flux than a membrane made with the same polymer but without the α -Al particles. Unexpectedly, the net flux is improved by treating the membrane with a solution of sodium hypochlorite...” (see Abstract) and “It is critical that the particles be α -Al which are basic (pH in the range from about 8 to 10) and that they be added prior to grafting ...” (col. 2, line 67 - col. 3, line 2).

Because the support structures disclosed in the '473 patent are not membranes, there is no requirement for flux, let alone unexpectedly improved net flux through the

polymeric shell of the '473 patent. Because of the criticality of the α -Al particles in the '039 patent, one skilled in the art would not interchange the '039 continuous layer of polyvinylidene fluoride (PVDF) interspersed with α -Al particles and then grafted with a *hydrophilic* polymer to form a copolymer, with the tactic polymeric shell of the '473 patent, uniquely suited for coating the complex geometric configuration of the '473 support structure, for fear of losing the unexpectedly improved net flux provided by the unique polymeric copolymer of the '039 patent. Thus, Applicant respectfully submits that there is no suggestion to make the '039/'473 combination.

Claims 2 and 4 stand rejected for reasons of obviousness based on the '039 patent and patent '193. Claim 2 is now cancelled, so that rejection is moot, but the limitations of claim 2 have been added to claim 1. In that respect, patent '193 teaches only a single layer, which impregnates the support material (see col. 3, lines 44-51; claims 1, 8 and 21). In the membrane of instant claim 1, the middle layer is selected from the group consisting of "an epoxy, a polyurethane, a silicone, an adhesive, a monomer, a polymer, and a combination thereof" and the barrier layer now recites that the barrier layer consists of "8-60% of at least one hydrophobic polymer, 1-20% of at least one hydrophilic polymer, 1-20% of an inorganic additive, 1-10% of a monomer, 1-10% of an organic additive, and solvent". Thus, as stated above for the § 103(a) rejection of claim 7, the '039/'193 combination does not teach all the elements of claims 2 (now in claim 1) and 4.

Similarly, combining patent '193 with the '039 patent renders the '039 patent unsatisfactory for its intended purpose, because again, the unexpectedly improved net flux seen with the unique copolymer disclosed in the '039 patent would be lost with such a combination. Moreover, the film layer in patent '193 impregnates the support layer, whereas in patent '039, the copolymeric dope is applied to the support layer by "extruding the dope *on* to the support" (col. 3, lines 59-60, emphasis added) not *into* the support.

Thus, there is no motivation to combine the '039 patent with the '193 patent, or to modify the '039 patent and/or '193 patent as would be needed to arrive at the presently claimed invention.

Because the combinations cited by the Examiner fail to teach or suggest all the elements of the claimed membrane in instant claim 1, and because there is no motivation or suggestion to make the cited combination, or modify the cited art, Applicant respectfully submits that there is no *prima facie* case of obviousness and the claims are patentable over the cited combinations.

In addition, further support for the novelty of the claimed membranes is found in the attached copy of an article from *Membrane Quarterly*, Vol. 21, No. 2, April 2006, which is an official publication of North American Membrane Society. There is a Patent Report on page 19 of this issue about Dr. Ji's membranes which highlights the importance of his invention regarding how to solve a tough industrial problem by "making mechanically robust composite fibers on a braided support" This report states "we recommend U.S. Published Application 2006/0000766, to inventor Jiang Ji." That published patent application is a divisional application to the present application, and is directed to the process claims 10-16 not elected with this application, and so cancelled herein. For your convenience, the cover page and Patent Report pages are attached. Dr. Ji's patent application is the first one in this report, and this report reflects the official opinions from the North American Membrane Society and membrane experts.

The Patent Report further indicates: "The adhesive layer binds the selective layer to the braid support, resulting in membranes with burst pressure of up to 100 psi, and a pure water flux up to 55 gfd/psi. A control membrane without adhesive provided a water flux up to 140 gfd/psi, but a burst pressure of only 40 psi. "

For at least the above reasons, Applicant respectfully submits that the instant claims satisfy the written description requirements and are novel and non-obvious over the prior art. Withdrawal of the §112, para. 1, §102, and §103(a) rejections is therefore respectfully requested.

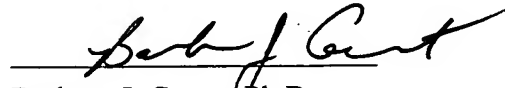
CONCLUSION

Applicant respectfully submits that all pending claims are in condition for allowance. Reconsideration of the claims and a notice of allowance are therefore requested. Applicant believes that no extension of time is required for this matter, but hereby submits this conditional petition for an extension of time, if needed, and requests that any fee required for timely consideration of this application be charged to Deposit Account No. 19-4972.

If the Examiner finds that there would be patentable subject matter if additional amendments were made, or if the Examiner has any questions as to the allowability of the currently pending claims, or if there are any defects which need to be corrected, the Examiner is invited to speak to the Applicant's counsel at the telephone number given below before issuing a further action.

Respectfully submitted,

June 21, 2006

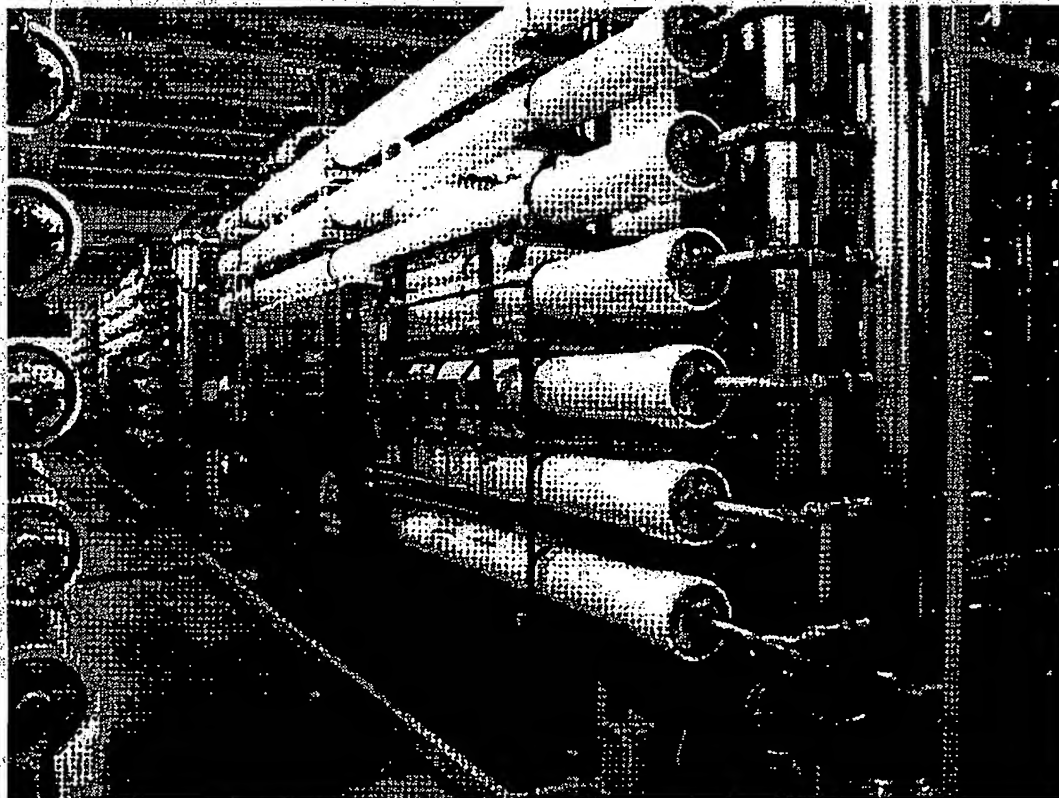

Barbara J. Carter, Ph.D.
Registration No. 32,703

BROMBERG & SUNSTEIN LLP
125 Summer Street
Boston, MA 02110-1618
Tel: 617 443-9292
Fax: 617 443-0004
03071/00102 509512.1

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Guest Viewpoint by David Bohonak

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Patent Report

This quarter, we collected 70 patents and published applications, with a strong emphasis in three categories: gas separation, fuel cells, and wastewater treatment. As this is the April 1 issue of *MO*, we have taken the liberty of emphasizing the lighter side of our job as reporters.

Last quarter, we reported on immersible hollow fiber membranes for water treatment. This quarter, there was again much patent activity (7 patents and applications) in this area. The enthusiasm we have been seeing is not surprising; the potential membrane market for tertiary municipal water treatment systems has been projected to be \$5 billion per year, and this segment of the membrane industry has already overtaken RO in annual market size.

For a detailed, informative and entertaining read about the issues that must be dealt with in making mechanically robust composite fibers on a braided support, and the joys of filtering wine, water and soy milk, we recommend U.S. Published Application 2006/0000766, to inventor Jiang Ji. This application describes hollow fiber composite membranes that will not delaminate when subjected to high-pressure backflushing. The membranes are made by a double-coating procedure similar to that reported in the Mitsubishi patent last quarter. This time, however, the first layer that coats the tubular support is a porous epoxy, polyurethane, or silicone adhesive, and this layer is immediately overcoated with a polyvinylidene difluoride selective layer. The adhesive layer binds the selective layer to the braided support, resulting in membranes with a burst pressure of up to 100 psi, and a pure water flux up to 55 gfd/psi. A control membrane without adhesive provided a water flux up to 140 gfd/psi, but had a burst pressure of only 40 psi. Figure 1 shows a cross section of the adhesive-containing fiber.

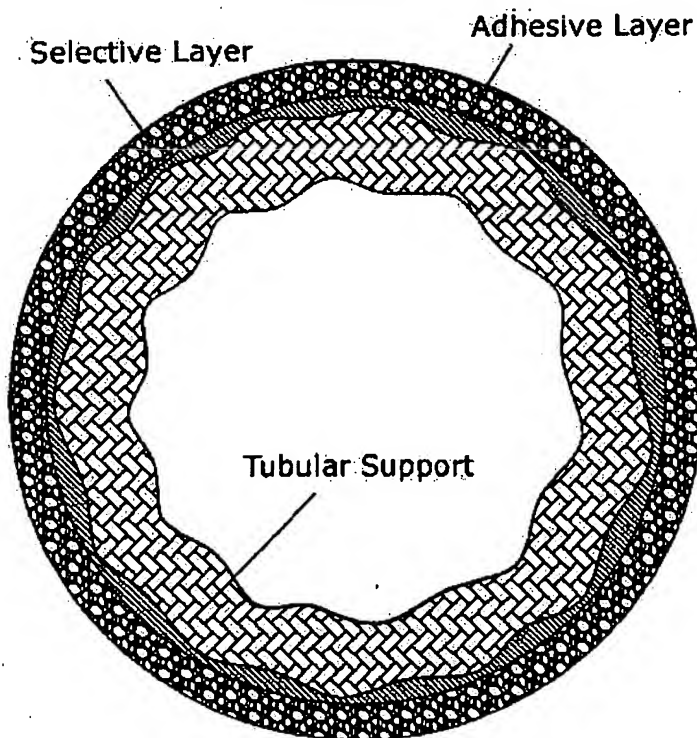


Figure 1. Composite hollow fiber membrane on a braided support, including an adhesive layer between the braid and the selective coating. From U.S. Published Application 2006/0000766